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1 BACKGROUND OF THE INVENTION:

2 This invention relates to a new and improved, biodegradable  
3 biocide composition having mold inhibiting or prevention activity  
4 and which provides both long and short term activity in animal  
5 husbandry use, and for the medical and food industry, and the  
6 like. The present biocide composition retains activity in the  
7 presence of significant amounts of organic matter and hard water,  
8 and provides an activity having a short inception time, and for  
9 a significant period thereafter; also, the shelf life of the  
10 present composition has a significant shelf life.

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12 Biocides for use particularly in animal husbandry locations,  
13 and the like, require a suitable activity against a wide variety  
14 of microorganisms such as bacteria, molds, spores and viruses,  
15 and in the presence of significant amounts of organic matter and  
16 using hard water. Additionally, this activity should have a  
17 short inception period such as ten minutes, and be effective for  
18 a significant period of time thereafter, such as for at least  
19 five hours. Also, these biocides should be capable of being used  
20 not only for spraying onto surfaces, but also to inhibit or  
21 remove airborne contamination, particularly in poultry houses,  
22 where dust and airborne particles may carry many types of  
23 diseases. Also, biocides generally should be biodegradable, and  
24 possess a long shelf life yielding phase and composition  
25 stability such as about twelve to eighteen months.

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27 Many biocides are well known, and publications of these  
28 types are found in U.S. Patents 3,028,299; 3,150,096; 3,367,877;  
29 3,438,905; 3,644,650; 3,697,651; 3,728,449; 4,059,615; 4,107,312;  
30 4,226,866; 4,923,899; 4,957,912; 4,983,635; 5,030,659; 5,124,359;  
31 5,284,875; 5,344,838; 5,338,748; 5,368,868; 5,391,379; 5,419,908;  
32 5,500,138; 5,668,102; 5,891,922 and, French Patent 2,622,397.

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1 U.S. Patents 5,338,748 and 5,344,838 both disclose using  
2 arsenic, chromium, cyanides, lead and selenium in the intended  
3 compounds, which would make them totally unsuitable for animal  
4 husbandry purposes. Hence, it is considered these patents do not  
5 describe a combination of the desired properties of a biocide  
6 composition for the intended usage. U.S. Patents 3,728,449 and  
7 5,368,868 describe the use of iodine, propylene glycol and a  
8 block copolymer of polyoxyethylene and polyoxypropylene as a  
9 germicidal composition, but they are used as a bovine teat dip,  
10 and are too mild as a biocide in an animal husbandry environment.

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12 THE INVENTION:

13 According to the invention, a biocide composition is  
14 provided comprising, propionic acid and iodine (I or I<sup>-</sup>) or an  
15 iodine containing compound such as hydriodic acid (HI<sup>-</sup>) or  
16 equivalent such as NaI, KI, CaI<sub>2</sub>, etc., and iodophors. HI<sup>-</sup> is one  
17 of the preferred iodine containing compounds since it promotes  
18 phase and composition stability, thereby adding about twelve to  
19 eighteen months to the shelf life at ambient temperature.

20  
21 The propionic acid functions to control pH, and to combine  
22 with ambient NH<sub>3</sub> to form ammonium propionate, thereby producing  
23 residual biocidal activity, which inhibits or prevents  
24 microorganism formation, including mold formation. The  
25 composition may have efficacy as a bovine teat dip, either as  
26 ammonium propionate and/or as propionic acid with iodine. Other  
27 propionates such as butyrates, valerates and isovalerates and  
28 their salts (e.g., Ca, Na, K, etc.), esters, etc, may be used.

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30 Air spraying with minimal or no water, will neutralize or  
31 minimize airborne contamination such as dust, organic material  
32 and particulates which may harbor airborne diseases. Used in  
33 liquid form for spraying onto animal husbandry surfaces, instead  
34 of airborne spraying, the iodine containing propionic acid may be  
35 mixed with a surfactant to complex or stabilize the iodine.

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1        Added materials which may be employed include: water  
2        dilution; dust inhibitors such as propylene glycol; and,  
3        additional acidifying and buffering agents such as citric,  
4        lactic, sorbic, maleic and fumaric acids, and their salts, esters  
5        and mixtures thereof. Other stronger acidifying agents such as  
6        phosphoric and/or sulfuric acid, and the like may be used for  
7        imparting a suitable pH range to the composition of between about  
8        -1 to 5, while a narrower, preferred pH range is approximately  
9        -1 to 3.

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11        When used to spray surfaces, a suitable surfactant carrier  
12        is a block copolymer of propylene oxide and ethylene oxide such  
13        as sold by BASF Corp. under the registered trade marks of  
14        PLURONIC<sup>®</sup> and TETRONIC<sup>®</sup>; these copolymers are nonionic, liquid  
15        surfactants with an HLB range of about 1.0 - 7.0. Other liquid,  
16        anionic, biodegradable surfactants having iodine complexing  
17        capability in the same or similar HLB range may be employed, and  
18        are found in "McCutcheon's Emulsifiers & Detergents", Vol. 1:  
19        1989 to 1999 (incorporated herein, by reference).

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21        Suitable surfactants are also described in U.S. Patents  
22        5,534,266 and 5,720,984 (incorporated herein by reference), the  
23        latter patent disclosing a non-ionic, laureth (11 - 16)  
24        carboxylic acid surfactant teat dip and hand foam which is highly  
25        suitable as the surfactant for use in this invention. Additional  
26        publications concerning bovine teat dip formulations are  
27        described in U.S. Patents 4,012,504; 4,049,830; 4,759,931;  
28        5,529,770; 5,641,498; 5,368,868; 5,616,348; and, 5,651,977.  
29        Polyethenoxy detergents and I, are disclosed in an article by  
30        Benjamin Carroll in the Journal of Bacteriology, 69: 413 - 417,  
31        (1955). A PVP surfactant for a teat dip is also suitable, and  
32        also one sold by Norman Fox & Co. under the trade name of NORFOX  
33        N-P9, and listed in "McCutcheon's Emulsifiers and Detergents  
34        1989", specifically for use with iodophors.

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1 Other types of teat dips are sold as Klenzade™ Teat Guard  
2 containing a nonyl phenoxypolyethoxy ethanol surfactant and  
3 titratable iodine. U.S. Patent 5,616,348 (supra) discloses a  
4 polyethoxylated polyoxypropylene block copolymer (Poloxamer) and  
5 iodine, but which does not employ propionic acid.

6  
7 U.S. Patent 5,967,202 to Ecolab, Inc. describes the  
8 manufacture of bovine teat dips by feeding components from an  
9 automatic dispensing apparatus to a milking station. The Ecolab,  
10 patent lists a wide variety of medicaments and surfactants which  
11 may be used in the manufacture of bovine teat dips, and are  
12 incorporated by reference herewith. The Ecolab patent also  
13 describes the use of defoaming agents for processing purposes  
14 (col. 19), which is distinct from a foam bovine teat dip.

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16 A broad concentrate composition comprises: iodine: at least  
17 about 0.1%; hydriodic acid: at least about 0.01%; propionic acid:  
18 at least about 10%; phosphoric acid and/or sulfuric acid, and the  
19 like: sufficient to obtain a pH of about -2 to 3; a buffer: at  
20 least about 1%; and, a polyhydric alcohol such as propylene  
21 glycol, glycerol, mannitol, sorbitol, butylene glycols, and the  
22 like: at least about 5%, all parts by weight.

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24 A narrower, preferred composition comprises: iodine: about  
25 0.1% - 5%; hydriodic acid: about 0.01% - 2%; propionic acid, and  
26 the like: about 10% - 75%; phosphoric acid, and/or sulfuric acid,  
27 and the like: sufficient to obtain a pH of about -2 to 3; a  
28 buffer: at least about 1%; and, propylene glycol, and the like:  
29 about 5% - 30%, all parts by weight.

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1 A coverage of from 2,500 - 30,000 square feet of surface  
2 preferably uses 5 - 60 gallons of concentrate for 100 - 1,200  
3 gallons of potable water (1: 20), and employs an inception  
4 contact time of about ten minutes and a contact period of  
5 preferably about five hours. The composition is usually  
6 dispensed using a coarse spray for maximum contact and  
7 penetration, or by atomization into ambient air so as to  
8 neutralize dust and organic material, etc. which may harbor  
9 airborne contamination; and, by fumigation. Typically, the  
10 product is used on, but not limited to dirt floors, new and used  
11 litter, rice hulls, oyster shells, concrete floors, and any other  
12 substrate material where animal husbandry is conducted.

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14 Prior to use, all poultry, animals, feed and portable  
15 equipment may be removed from the premises to be treated to  
16 assure adequate surface coverage, and all water troughs and feed  
17 racks are emptied. Alternatively, since the present composition  
18 employs feed grade components, it is not required to remove  
19 animals during use, and the premises may be treated in the  
20 presence of animals as an ongoing remedy for retarding NH<sub>3</sub> build-  
21 up, and/or microorganism development and growth. Surfaces such  
22 as floors, ceilings, walls, walkways, etc., of an animal  
23 husbandry facility which may include poultry houses, cattle  
24 barns, swine facilities, cattle facilities, zoos, and other  
25 animal raising facilities are washed and disinfected with a  
26 suitable detergent and disinfectant, and allowed to dry.

27  
28 The biocide solution of this invention is then sprayed  
29 downwardly from the curtains to the floor and thoroughly wetting  
30 the desired area to be disinfected. The solution should be  
31 allowed to contact the treated surface for a period for at least  
32 ten minutes, and the buildings, coops and other closed spaces  
33 under treatment should be thoroughly ventilated. Shoe baths  
34 containing one inch of biocide solution should be placed at the  
35 entrance to a facility and replaced daily.

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1 In general, viruses, bacteria, vegetative spores, protozoa  
2 and viruses are sterilized by the composition of this invention,  
3 and typical organisms which can be neutralized by the composition  
4 of this invention in the presence of 50% organic soil and 1,000  
5 pm hard water, at dilutions of 1:20, include: vegetative  
6 clostridium perfigens, which is known to cause gangrenous  
7 dermatitis in poultry. Also included in the above test scheme  
8 were tests performed in conformance with A.T.C.C., Fifteenth  
9 Edition on the following: staphylococcus aureus A.T.C.C. 6538;  
10 salmonella choleraesuis 10708; pseudomonas areuginosa A.T.C.C.  
11 15442; salmonella pullorum A.T.C.C. 9184; salmonella enteritidis  
12 A.T.C.C. 13076; clostridium perfigens A.T.C.C. 13124 (vegetative  
13 cells); salmonella typhimurium A.T.C.C. 14028; escherichia coli  
14 A.T.C.C. 25922; pasteurallae multocida A.T.C.C. 43137;  
15 aspergillus fumigatus A.T.C.C. 36807; aspergillus glaucus  
16 A.T.C.C. 14567; and, infectious bursal disease virus (GUMBORO).

17  
18 In addition to the above organisms which are neutralized by  
19 the biocide composition of this invention, harmful odors in an  
20 animal facility are neutralized; this prevents molds and other  
21 harmful microorganisms from becoming airborne.

22  
23 Moreover, sterilization is obtained even in the presence of  
24 high levels of organic matter including, but not limited to dirt  
25 floors, manure and litter. Presently, disinfectants are limited  
26 to functioning well in the presence of only about five to ten  
27 percent of organic matter, but the composition of this invention  
28 functions in the presence of about 50% organic matter and at high  
29 levels of water hardness, such as up to about 1,000 ppm.

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1           The composition of this invention provides an inexpensive  
2   and reliable biocide for sterilizing animal husbandry surfaces  
3   which is effective in high levels of organic material, for  
4   effective periods of contact time, and which retains potency for  
5   about twelve to eighteen months at ambient temperatures. As  
6   mentioned, it is possible that the composition of this invention  
7   may also have efficacy as a bovine teat dip.

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